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A table of contents for *Journal of the Transactions of the Victoria Institute* can be found here:

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## ORDINARY MEETING, APRIL 7, 1879.

THE REV. R. THORNTON, D.D., VICE-PRESIDENT, IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

ASSOCIATES :—Rev. D. Fotheringham, London ; Rev. R. Lamplough, South Africa ; Rev. P. Tearle, South Africa ; J. C. Pinkerton, Esq., South Africa.

Also the presentation of the following Works for the Library :—

“Proceedings of the Royal Society.”	<i>From the same.</i>
“Proceedings of the Royal Geographical Society.”	<i>Ditto.</i>
“Warwickshire Natural History Society Report, 1878.”	<i>Ditto.</i>
“Genesis and Migration of Plants.” By Dr. Dawson, F.R.S.	<i>Ditto.</i>
“Everlasting Punishment.” By Mrs. McLaughlin.	<i>Ditto.</i>

The following paper was then read by the author, who, owing to indisposition, was assisted by the Rev. T. M. GORMAN :—

*THE CONTEMPORANEITY OF MAN WITH THE EXTINCT MAMMALIA, AS TAUGHT BY RECENT CAVERN-EXPLORATION, AND ITS BEARING UPON THE QUESTION OF MAN'S ANTIQUITY.*  
By THOS. KARR CALLARD, F.G.S.

IN the paper that I am about to read to you to-night I will confine my attention exclusively to British caverns, because they have had the advantage of more careful and scientific exploration than any others.

The senior members of the Victoria Institute may remember the interest that was excited in 1821 by the accidental discovery of a cavern in Kirkdale, Yorkshire, containing unusual animal remains; but especially those of the hyæna. The exploration was conducted by Dr. Buckland, afterwards Dean of Westminster, a geologist of much celebrity. In one cavern he found remains of as many as seventy-five hyænas. How was this to be accounted for? Had the explorer come across an ancient

menagerie, or were these the animals which in former days roamed over the wolds of Yorkshire?

The interest belonging to this discovery had not died out, when it was announced that at Torquay, in Devonshire, similar remains had been found in Kent's Cavern beneath a stalagmite flooring. This Devonshire cavern had been frequented by picnic parties for some centuries past, but it was not till 1825 that any one knew what was beneath the stalagmite. From that time until 1840 the Devonshire naturalists were every now and then surprised by having some strange bone or unusual tooth brought under their notice. These relics were dug up by Mr. McEnery, a Roman Catholic priest, to whom this cavern had become a favourite place of research.

In 1840 the cave was explored with more system by Mr. Godwin Austen, who identified the remains of the hyæna, the bear, the woolly rhinoceros, and the mammoth. These remarkable remains, now well authenticated, made the naturalist still more eager for fresh exploration, an opportunity for which again presented itself by the discovery, in 1858, of another cavern in the face of a limestone hill overhanging the little harbour of Brixham.

Cavern-research had now become of sufficient importance to be taken up by the Royal and the Geological Societies. These societies appointed a committee from amongst their number to systematically explore this cavern at Brixham, and to determine the species of animal to which each bone belonged that should be found therein. The same arrangement was also come to for the exploration of Kent's Cavern.

The committee numbered amongst them some of the leading geologists and palæontologists of the day. And the superintendent appointed was Mr. William Pengelly, F.R.S., now so well known for his untiring labours in cavern-research. The work was no sinecure, for when Professor Dawkins went to Kent's Cavern to determine the bones, there were no less than 50,000 labelled and set aside for examination, with a complete record of the exact spot where each bone was found.

Not only did the explorers find the bones and teeth of animals that had not lived in this country within the memory of man, but also those of animals supposed to have been extinct long before man's creation. They also met with the remains of animals now found only amongst the snows of the North, mingled with those whose habitat is the sunny South.

Whilst these cavern revelations were being made in England, at Abbeville and Amiens, in Picardy, bones of some of the same extinct mammalia, notably those of the mammoth and the Siberian rhinoceros, were being dug out of the gravel-beds of

Moulin Quinon and St. Acheul, and with them chipped flints, so chipped that M. Boucher de Perthes, the antiquarian, of Abbeville, and Dr. Rigolot, of Amiens, were convinced that they were the work of man, and if so, pointed to the contemporaneity of man with these extinct mammals. Whether these chipped flints are, indeed, the work of man, or whether the chipping is to be attributed to accidental fracture of the flint in the *mélée* which brought them where they are found, is a question which it will not be necessary to enter upon now, as in Kent's Cavern the more palpable works of man, such as bone implements, are found associated with these extinct mammals.

But all questions respecting both the contemporaneity of man with the extinct mammalia, and also the age of man, appeared for a time as if they were going to be set at rest by the discovery of a cavern near Settle, in the West Riding of Yorkshire, nine hundred feet above the Ribble, in the limestone hill known as King's Scar. The cavern was discovered as far back as the day of her Majesty's coronation, from which circumstance it was named Victoria Cavern.

The early finds were those which more deeply interested the antiquarian. They consisted of fragments of pottery; of Roman coins of the reign of Trajan and Constantine; of spindle whorls and beads; of bronze ornaments and ladies' brooches, the latter beautifully enamelled in red, blue, yellow, and green; they were delicate in workmanship, and of graceful design. The treasures pointed to the explanation that this cavern, away up on the bleak hills, had been a place of refuge to some Romano-Celtic families of the first few centuries of the Christian era.

More recent excavations in Victoria Cavern have shown that it had had in times still more remote, other occupants than Romano-Celts, for the workmen on digging below the first floor came upon another, thickly strewn with bones of a different character to those with which they had been familiar.

Amongst the bones, the osteologist found those of the hyæna, grisly bear, hippopotamus, *Bos primigenius*, woolly rhinoceros, and the mammoth. And following this bone-bed beneath the clay to the outside of the cavern, a portion of a bone was discovered which presented some difficulty in its determination. It was therefore sent to London to Professor Busk, who at first considered it to be the fibula of a small elephant, with which decision the late Mr. James Flower (articulator of the College of Surgeons) agreed; but after some months Professor Busk gave it as his altered opinion that it was *human*, and read a paper upon the bone before the Anthropological Institute, and on another occasion referred to it as representing "one of the earliest extant specimens of humanity."

At the same time the clay under which the bone was discovered was decided by the explorer to be glacial clay.

If these two decisions had proved correct, the contemporaneity of man with the extinct mammals was put beyond question, and equally so the antiquity of the man to whom the bone belonged. It was not a flint implement this time, which might admit of some doubt, nor even a bone needle, but a supposed part of the man himself, that was now found with woolly rhinoceros and mammoth.

A report was read upon the subject by Mr. Tiddeman, at the British Association meeting at Belfast, in 1874; and from that time it was generally accepted as a settled truth that man had lived before the great Ice age in association with the extinct mammals whose remains were found in this bone-bed.

In the autumn of 1876 I visited the cavern in company with Mr. Jackson and a gentleman connected with the Leeds press. Mr. Jackson it was who commenced the exploration when the entrance to the cave was first discovered; he was also thoroughly acquainted with its subsequent working. We were indebted to his kindness for much valuable information.

One thing led me to doubt the glacier having deposited the clay after the bone in question had been left there,—it was the laminated condition of the clay. The model on the table shows a section of the deposits at the entrance of the cavern. The bone was at this spot (*pointing to the model*) with laminated clay both below and above it; and next you will observe two strata of stalagmite. The lamination appeared to me to imply an intermittent deposit, the result of a succession of wet and dry seasons, whilst the stalagmite gave evidence of other and greater dividing periods,—a condition of things which I should not expect to find with glacial clay *in situ*.

At my suggestion our party of three climbed to the top of the limestone rock that overhung the entrance to the cavern, from which spot we saw that the hill sloped up full 300 feet more, and on this sloping plateau we found several stranded boulders that had travelled on the ice from other elevations. Where the boulders were, there, doubtless, the boulder clay had been; and I thought that I now saw the explanation of the laminated clay below.

If, instead of the glacier having left the boulder clay at the mouth of the cavern, the glacier had come up higher (which the boulders at the top proved that it did) and had deposited the clay upon the sloping plateau above, the winter rains disturbing the clay would carry in suspension portions of it from time to time over the precipice, which drying after the water subsided, would produce the laminae observed, and this would

have taken place exactly where the bone was found, which was not really in the cavern, but just at its entrance.

If this explanation is admitted, then the boulder clay is but *remanié*, and may have been deposited long after the glacier had ceased to move in the Ribble Valley. My firm conviction is that neither the bone in question, nor any of the other bones in this deposit are pre-glacial.

So much for the age of the bone, but now a word or two more about the bone itself. Prof. Boyd Dawkins, in his interesting book on Cave-hunting, p. 121, says "that the comparison of the bone with a specimen in the possession of Prof. Busk removed all doubt from his mind as to its having belonged to a man who was contemporary with the Cave Hyæna, and the other Pleistocene animals found in the cave." And again, referring to the bone, he says, p. 411, "The man to whom it belonged was probably devoured by the hyænas who dragged into the den the Woolly Rhinoceros, Reindeer, and other creatures whose gnawed bones were strewn on the floor."

But Prof. Rupert Jones gave us a more minute description of the bone and of the relations of the man to whom it belonged. In a lecture on the Antiquity of Man, delivered April 26th, 1876, he says that the bone "is platycnemic in character, that is, it belonged to some sharp-shinned race, such as are found in the old deposits at Gibraltar, Central France, and North Wales."

And so the evidence appeared to stand until 11th April, 1877, when Prof. Dawkins, in concluding a paper before the Geological Society, with a candour quite characteristic, expressed his growing doubt about the human origin of the bone, and at a conference convened by the Anthropological Institute in the following month, to consider "the present state of the question of the Antiquity of Man," Prof. Dawkins then gave his reasons for believing that instead of the bone being human it was a portion of the fibula of a bear. The reasons were judged conclusive, for almost without exception the palæontologists then present were prepared to give it up. Prof. Busk rose to say, respecting the bone, which he facetiously designated the bone of contention, that he "was perfectly open to be convinced that it might be ursine." And at the late meeting of the British Association at Dublin, a communication from Prof. Busk was read, in which he says, "I have received from Toulouse two ursine fibulæ of abnormal size, which in the part corresponding to the fragment of contention so closely resemble it as to leave little room for doubt that the latter is, or may be, in reality ursine, and not human; I am disposed, therefore, to acknowledge

that my diagnosis of the Victoria Cave bone was in all probability erroneous."\*

The Committee with equal candour gave publicity to their decision that any argument based upon the bone's supposed character must be unreservedly given up.

I hold in my hand a human fibula, and have coloured that portion which corresponds to the fragment which has given rise to so much discussion. It is but six inches in length and without any articulation.

And here is another human fibula marked in a similar way. This one belonged to a man of large stature. You will observe how different the two are in form. Such a fragment of a bone so variable will leave it less a wonder that a mistake should have been made, than that there should have been the venture to determine a species from such a fragment.

We are left, then, where we were before, to argue the contemporaneity of man with the extinct mammalia from his handiwork, and not from the presence of any portion of his frame.

But the next and latest case of cavern exploration introduces a new feature into the argument.

On the estate of the Duke of Portland, at the north-east of Derbyshire, there is a beautiful dale known as Creswell Crags, where the shadows of the adjacent rocks, with their rich foliage, are reflected in the clear waters of an artificial lake that separates certain natural caverns in the limestone. Three of these caverns have lately been explored by the Rev. J. M. Mello, F.G.S.,—the Pin-hole and Robin Hood's Cave on the left side of the lake, and Church Hole on the right.

Within these caverns and on the surface were found ornaments of the same age and character as those in the Victoria Cavern, and on digging beneath the surface into the cave-earth Mr. Mello met with the bones of lion, bison, hyæna, tooth of machairodus, and also with the presence of woolly rhinoceros and mammoth; and associated with these remains were two or three fine bone implements, a perfect bone needle, some awls, a kind of gouge,† and an oval ironstone implement; and lastly, to the great joy of the finder, he extracted from this cave-earth, in the presence of Prof. Dawkins and Mr. Tiddeman, a bone which had scratched upon it the outline of a horse's head.

We have now, then, got overwhelming evidence of man's existence in Derbyshire at the same time as the woolly rhinoceros and mammoth. But now comes the question, what order of man? To what period did he belong? Most assuredly it was

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\* *Daily Express*, Dublin, August 17, 1878.

† *Quarterly Journal Geological Society*, vol. xxiii. p. 586.

not Palæolithic man. Palæolithic man, if such a being ever existed, was a low savage, incapable of anything higher than simply chipping a flint for his weapon ; when he reached the capacity of smoothing that weapon we had then arrived at the Neolithic age. Mr. Sydney Skertchley, F.G.S., who is now writing upon the subject of "The Antiquity of Man," says of the Palæoliths that they "were more degraded than any known savage tribe."\* But these men of Creswell Caves were workers in bone, artificers who used awls and gouges. They knew the use of the needle, and also wrought in iron,† for they left behind them one oval ironstone implement, and two more leaf-shaped, all worked to approved forms.‡ There were also artists amongst them, for one of them had left his artistic product in the cavern, and Professor Boyd Dawkins, as an art critic, describes the work as follows :—"The most important discovery of the handiwork of man is the head and fore-quarters of a horse incised on a smoothed and rounded fragment of a rib, cut *short off* at one end, and broken at the other. On the flat side the head is represented with the nostrils, and mouth, and neck carefully drawn. A series of fine oblique lines show that the animal was hog-maned. Indeed, the whole is very well done, and is evidently a sketch from the life."§

Is this, Mr. President, the kind of product that you would expect from a Palæolithic savage ?

Observe the artist's care in preparing his tablet. The bone is first "smoothed and rounded." It is "cut short off at one end." I particularly noticed in the bone the clean cut, and will ask the members of this Institute, could you cut a bone clean through with a Palæolithic implement ? It looks much more like having been done with a saw. I don't say a metal saw—saws have been made of flint ; but there has been no proof of saws in Palæolithic times ; and, then, observe that "the engraving is evidently a sketch from the life," and that the living model was a *hog-maned* horse.

Horses are not *hog-maned* in a state of nature, *hog-manes* are cut manes. The artist, then, that drew this horse lived at a time when horses' manes were cut to fashion ; but Palæolithic times were by no means fashionable times either for men or horses.

It is also evident that you could not cut horses' manes with

\* *English Mechanic and World of Science*, March 28, 1879, p. 49.

† I accept the correction of the Rev. J. Mello made at the meeting. I ought to have said wrought on ironstone, instead of wrought in iron.

‡ *Journal of the Anthropological Institute*, November, 1877, p. 153, *Quarterly Journal Geological Society*, 1877, pp. 582, 586.

§ *Quarterly Journal Geological Society*, 1877, p. 592.

Palæolithic implements. To make a hog-maned horse you must *clip* the mane, and this suggests a pair of shears, which, as far as I know, are always made of metal; and until Mr. Mello or Prof. Dawkins find some stone shears I shall certainly believe that these hog-maned horses lived not in the Palæolithic, but in the metal age. I quite agree with what Professor Dawkins says about the careful drawing of the nostrils, and mouth and neck, and that the whole is well done, so well done that its very excellence is an *à priori* argument that Palæolithic man did not do it.

I am then quite prepared to accept the proof afforded by Creswell Caves of the contemporaneity of man with the extinct Mammalia—but not of palæolithic man.

I know that it has always been assumed that *Rhinoceros tichorinus* and mammoth became extinct at so remote a period that any remains of man found with them are at once pronounced palæolithic. Mr. Mello and Prof. Dawkins always speak of the Creswell Cave men as palæolithic on that account. And Mr. Pengelly says, "Whilst a geologist would hesitate to pronounce a deposit of palæolithic age, merely because he had found in it a solitary unpolished flint implement, his hesitation would vanish in a moment if he also detected a relic of the cave-bear or woolly rhinoceros, or any other extinct mammal.\* Mr. Skertchley places the Palæolithic fauna prior to the formation of the English Channel, and at the time when the German Ocean was a fertile plain.

When, therefore, the remains of man are found with these extinct mammals, the antiquity of man is accepted as a matter of course.

Now the remote date at which *Rhinoceros tichorinus*, mammoth, and the cave-bear became extinct is one of those supposed facts that it would be more in accordance with science to prove rather than to assume.

It must also be remembered, that when the geologist speaks of the antiquity of man he does not mean what would be meant by the Egyptologist by that term. Chevalier Bunsen claimed for the human period 20,000 years, but the geologist is thought very moderate who asks for 200,000.

There is a tooth of *Rhinoceros tichorinus* on the table, and also one of mammoth; they both came from the caves under consideration.

I do not know how long such teeth will last, but certainly there is nothing in their appearance that would lead me to say that they are 200,000 years old, or older than the English Channel or the German Ocean.

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\* *The Flint and Chert Implements in Kent Cavern*, p. 31.

I think the time has now fairly come to ask calmly the question, whether finding the works of man in association with *Rhinoceros tichorinus* and mammoth, instead of proving man's great antiquity, does not rather prove the more recent extinction of these mammals, seeing that it is now found that they lived when men made polished bone needles, hammered out iron implements, drew horses' heads, and with metal shears cut their flowing manes.

We will now take a backward glance, and see how the previous evidence stands respecting the place in history of some of the best known of the extinct mammalia.

From the evidence afforded by the Victoria Cavern, Mr. Tiddeman thought he had proof of the presence of man, independently of the bone now handed back to the ursine family.

Mr. Tiddeman called attention to two bones with marks upon them, which indicated, to his mind, the work of man. These bones were found with the extinct mammalia; but on their examination at the Anthropological conference, it was suggested that the marks, if indeed cut by man, had been cut with a metal instrument; if so, the evidence would not be worth much in sustaining the doctrine of man's antiquity. But whatever were the doubts about the marking on the bones, of this, about one of them there appeared to be no doubt in the minds of competent authorities,—namely, that it was the rib-bone of a goat; and Mr. Tiddeman says of the goat, that it certainly had appeared in Victoria Cave in association with the remains of hyæna, *Elephas antiquus*, and *Rhinoceros leptorhinus*, showing that these extinct animals had not died out in Yorkshire when the goat lived amongst its crags and scars. Now the modern origin of the goat is distinctly recognized by osteologists, and was unknown in Europe before the Neolithic age.\*

The goat, then, gives us the clue to the age of his associates.

If we now go back to Kent's Cavern, Devonshire, where Mr. Pengelly has constructed a chronology from the cave deposits, we find a granular stalagmite that divides a layer designated the Black mould, from another denominated the Black band. The black mould represents the modern period, whilst the black band, together with the cave-earth, are the storehouse of antiquity. The granular stalagmite is then the supposed dividing-line between the far past and the present.

Whilst satisfied with such division in the main, I must yet remember that the hyæna, rhinoceros, elephant, and bear, were found in the same foot of *cave-earth* with the bat and rabbit in the excavation of Smeedon Passage. Rabbit was also found in

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\* Prof. Dawkins, *Macmillan's Magazine*, December, 1870.

association with rhinoceros and bear in that part of the sallyport named the Islands.—*British Association Report*, Edinburgh, 1871.

And in the cave of *Rodentia* in the second foot of cave-earth was found a tooth of *sheep*, with the teeth of *hyæna*, rhinoceros, bear, elephant, and lion.

Also, in the charcoal cave tooth of *sheep* was again found with *hyæna*, rhinoceros, and bear.

And in Long Arcade remains of *pig* were found, with rhinoceros, *hyæna*, and mammoth, in the undisturbed *cave-earth*.\*

If, then, these extinct mammals lived on till the time of the bat, rabbit, pig, and sheep, we must not attempt to draw the line too sharply between the palæolithic fauna and the present.

I would now direct your attention to the sixth report of Kent's Cavern, read by Mr. Pengelly at the British Association Meeting in Liverpool, 1870. He says, that "in exploring the North Sallyport, the overlying black mould yielded potsherds, marine shells, and bones (chiefly modern, but a few of *extinct* animals), the astragalus of the rhinoceros being the most important of the latter." You will observe, then, that bones of *extinct* animals, and notably the knuckle-bone of the extinct rhinoceros, was found, not only above the granular stalagmite but in the black mould, mingled with the bones of modern animals and with potsherds.

Now if we turn to Dr. John Evans' account of the cavern, we shall learn something more about these potsherds. He says in his valuable work upon "Stone Implements in Great Britain," that above the stalagmite, and principally in the black mould, have been found a "number of relics belonging to different periods," amongst which relics he mentions pottery; and then describes the pottery, some of it as "distinctly Roman in character," whilst some of it belonged to pre-Roman times.† *Rhinoceros tichorinus* lived, then, in Roman or pre-Roman times, and left his knuckle-bone amongst the pottery of that period. How is it, then, that we are asked to believe in man's great antiquity on the ground of man's remains being sometimes associated with those of this extinct animal? Clearly, in the case before us, the contemporaneity only proves that man lived some 2,000 or 2,500 years back, which no one doubts.

And this evidence is not unlike that of Creswell Caves, for Mr. Mello in his first paper upon their exploration read before the Geological Society, June 23, 1875, tells us that in the surface layer of Robin Hood's Cave he found several molars of

\* *British Association Report*, Belfast, 1874.

† *Stone Implements in Great Britain*; pp. 445, 446.

*Rhinoceros tichorinus* and some hyæna teeth; and continues to say the upper part of the floor of this cavern also contains a small piece of Samian ware, showing an ornamental rim, and with this two or three pieces of a coarse earthenware vessel; a few recent bones of sheep were also found here.\*

As in Devonshire, so in Derbyshire, *Rhinoceros tichorinus* is found amongst the pottery; the legitimate inference is that he was contemporaneous with the potters, Roman or pre-Roman, or Samian; also that he lived when the modern sheep browsed in Creswell dale.

Again, in the second report upon the caves, read before the same society, April 5th, 1876, reference is made to blasting the stalagmitic breccia which covered the cave-earth containing the bones and implements. In this breccia were found teeth of both rhinoceros and hyæna.†

And Professor Dawkins in his table of contents of Robin Hood Cave, under the head of Upper Breccia, enumerates the jaws and teeth as follows:—1 specimen of Irish elk; 1 of wild boar; 3 of horse; 2 of *Rhinoceros tichorinus*, and 6 of cave hyæna.‡

And in Mr. Mello's third report, read April 11th, 1877, he says, "The few remains found in the breccia consisted, as before, of bones of the hare, a few teeth of the larger pleistocene mammalia, *Rhinoceros tichorinus*, hyæna, bear, horse, &c. §

Prof. Dawkins in his paper, read the same evening, says "that the breccia of the previous exploration turned out to be a mere local deposit, which was represented in other parts of the cave by the upper strata of cave-earth."|| And in his paper at the conference, May 22, 1877, after describing the bone awls, needles, sketch of horse's head, and associated mammalian remains of the cave-earth, he says that "above the strata containing these remains was a layer of stalagmite ranging from one foot to a few inches in thickness."¶

Wherever the stalagmite, or stalagmitic breccia existed, it was always above the cave-earth; and where they did not exist, the upper stratum of cave-earth was their equivalent. Whatever, therefore, was found in this superincumbent layer of stalagmite, or in the stalagmitic breccia, or their equivalent, the upper stratum of cave-earth, must of necessity be more recent than the contents of the cave-earth below them, the upper deposits having been the last formed.

\* *Quarterly Journal of Geological Society*, vol. xxxi. p. 683.

† *Ibid.* vol. xxxii. p. 242.

‡ *Ibid.* p. 247.

§ *Ibid.* vol. xxxiii. p. 581.

|| *Ibid.* 590.

¶ *Journal of Anthropological Institute*, vol. vii. p. 154.

The evidence then clearly afforded by the Creswell Caves is, that *Rhinoceros tichorinus*, cave hyæna, and bear lived on to a more recent date than the men who made the bone awls, bone needles, and the engraver who incised the horse's head, for they are found above them, whilst the two species rhinoceros and hyæna had not ceased to exist at the time when ornamental Samian pottery was either made in Derbyshire or imported from Samos. How then can the contemporaneity of man with the extinct mammalia prove man's antiquity?

Let us now return to the Devonshire rhinoceros, which in Kent's Cavern left a portion of his frame amongst the Roman and pre-Roman remains.

I think we shall find that he did not so far outlive his congeners as to be a curiosity in his day, for not only his brother rhinoceros but also the cave-bear, cave-hyæna, and the mammoth, not content with the period of the cave-earth and black band, they had splashed their way into the cavern, or had been dragged in by some of their companions after a foot or more of the upper stalagmite had been formed, for their remains were found nearly on the surface, covered only by an inch and a half of this stalagmitic substance. Mr. Pengelly produces the case to prove the very slow formation of the stalagmite, but he must forgive me for drawing another lesson from the fact, and that is, the more recent existence of the mammals referred to.

I will give the passage in Mr. Pengelly's own words, as I shall have to refer to it again. Mr. Pengelly then says, in an address to the Devonshire Association for the Advancement of Science, July, 1874:—"I have found teeth of the cave-bear, cave-hyæna, the mammoth, and the tichorine rhinoceros so very little below the surface of the stalagmite in Kent's Cavern that more than an inch and a half at most of calcareous matter had not accumulated there since they were lodged where they were met with, whilst below them was a floor of the same material a foot, and sometimes much more, in thickness; and the situation was such as to place it beyond all doubt and question that they had not been dislodged from an older deposit and re-inhumed."\*

This is a good case for our investigation. An inch and a half of stalagmite, we learn, divides the remains of four of the most important species of extinct mammalia from the astragalus of rhinoceros found in the black mould containing Roman and pre-Roman pottery. We have, then, but to learn how long that inch and half took to form to enable us to determine how far removed in time were these mammals from the Roman or pre-Roman period. We have not much data from which to

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\* *Notes on Palæontology of Devonshire*, W. Pengelly, p. 21.

calculate the rate of stalagmitic formation ; it is a subject that has only lately engaged much attention, but we will make use of what we have.

Mr. John Curry had observed  $\frac{3}{4}$  of an inch which had formed on the edge of some deal boards used in connection with the working of a lead-mine at Boltsburn, near Durham. These boards, he knew, had only been there fifteen years. The particulars will be found in *Nature*, December 18th, 1873. Mr. W. Bruce Clarke called attention to one-eighth of an inch of stalagmite having formed on a gaspipe in Poole's Hole, near Buxton, six months after the pipe was placed there. It was so placed in March, 1861, eighteen years back. Since then the stalagmite boss has increased to  $1\frac{3}{16}$  inch ; and on the 24th of October, 1878, I obtained permission from the proprietor of the cavern, Mr. Redfern, to remove the boss, which I place before you to-night.

I have also an iron nail which had been left by the workmen in a forsaken lead-mine, called Rackets, on the road from Buxton to Castleton. The nail projected from a plank, and intercepted the drip from a stalactite. It has a delicate casing of stalagmite, a quarter of an inch in thickness. The branch of the mine in which this nail was found February, 1877, was worked in 1805 ; consequently the stalagmite must have formed in 72 years.

There were also careful measurements made by Mr. James Farrer in Ingleborough cavern in Yorkshire, in 1845, which, compared with those afterwards made by Prof. Boyd Dawkins on the same spot in 1873, showed an increase at the rate of more than a quarter of an inch in the year.

If the above-named cases were to be made the data for calculating the  $1\frac{1}{2}$  inch of stalagmite which divides the mammalia in question from the pre-Roman period, the Boltsburn case would fix the time at 30 years. The first observation in Poole's Cavern would lead us to accept six years for the time employed. But the accretion has not been uniform, for since then it has only increased at a rate that would require about 22 years to form the  $1\frac{1}{2}$  inch under consideration. Whilst, in the case of the nail before us, 432 years would be employed in producing the same amount of deposit ; but that of Ingleborough would only indicate five years.

Of course I do not say that any of these cases are to decide the time required for stalagmitic formation, but they show that it is not necessarily so slow a process as we had been led to think. Mr. Pengelly very justly asks, "Why must the rate of accretion in Ingleborough Cave be taken as the measure of other caves?" And he says that "it is unsafe to use the rate

at which stalagmite accumulates in one branch of a cavern to measure the time required by the stalagmite in any other branch of the *same* cavern, and that consequently, even if it had been uniform, the rate of the growth of the jockey-cap of Ingleborough Cave cannot be applied as a chronometer in the case of any other cave."\* Very true, and we will bear this truth in mind.

Mr. Pengelly's estimate of the rate of stalagmitic deposit in Kent's Cavern is  $\frac{1}{20}$  of an inch in 250 years.† This computation is made from the deposit upon an inscription on a boss of stalagmite at the entrance to the "Cave of Inscriptions," which inscription bears date about that number of years back. And Mr. Pengelly says, as the result, that "I am content with the modest hypothesis of 5,000 years for each inch of stalagmite."‡ If so, although the estimate for time is 250 times greater than that for the stalagmite at Boltsburn, more than 300 times greater than for the boss before you from Poole's Cavern, and 1,250 times greater than that at Ingleborough Cavern, yet this estimate of  $\frac{1}{20}$  of an inch in 250 years would only make the four species of extinct mammalia in question 7,750 years older than the pre-Roman pottery in the black mould, for  $\frac{1}{20}$  of an inch in 250 years is equal to  $1\frac{1}{2}$  inches in 7,750 years.

For the black mould Mr. Pengelly only claims about 2,000 years. He says, in a lecture delivered in the City Hall, Glasgow, upon "Kent Cavern and its testimony to the Antiquity of Man," "They found in the first deposit, or black mould, many artificial objects . . . that go back to the Roman and pre-Roman times; hence we come to the conclusion that the black mould, or uppermost deposit, is worth 2,000 years at least."§

If, then, I were to admit (which I do not) that the stalagmite has been uniform in its accretion, and that Mr. Pengelly's estimate of 1 inch for 5,000 years is the correct one, it would only bring us to this conclusion, that 9,750 years from the present time cave-bear, cave-hyæna, *Rhinoceros tichorinus*, and mammoth lived in the neighbourhood of the present Torquay.

\* *Note on Recent Notices of the Geology and Palaeontology of Devonshire*, part i. p. 21.

† *Ibid.* pp. 24, 25.

‡ Mr. Pengelly ought to be satisfied with 3,680 years, for it was as far back as 1872 when the estimate was made, and the inscription from which it was made was that of "Robt. Hedges of Ireland Feb. 20 : 1688" which would be but 184 years for the accretion of  $\frac{1}{20}$  of an inch; or 3,680 years for an inch. See Mr. Pengelly's lecture at Manchester on Kent's Cavern, December 18, 1872.

§ *Kent Cavern, its Testimony to the Antiquity of Man*, December 22nd, 1875, p. 17.

The contemporaneity of man, and the extinct mammalia as an argument for man's antiquity is virtually given up, if it is admitted that these mammals were not extinct 9,750 years ago, and yet I can reach no other conclusion from Mr. Pengelly's own estimate of stalagmitic rate of accretion applied to Mr. Pengelly's own statement of facts.

We must now ask a question about the uniformity of stalagmitic accretion,\* and we shall be helped in that inquiry by Mr. Pengelly's own description. It is as follows :—"The roof of the cavern is of limestone, and through it in rainy weather the water percolates slowly in most cases, but sometimes more rapidly. That water contains carbonic acid. It is by that carbonic acid that the water dissolves the limestone which constitutes the roof. It reaches the inner surface of the roof, and hangs there as a drop. You come into the cavern and hear a drop here and a drop there, and you know what process is going on. The limestone has been dissolved overhead, and as the water falls it brings a particle of the limestone to the floor, where it is precipitated. It sooner or later forms a little boss, more or less conical ; thence it flows away, and meeting that flowing from other such bosses, a sheet is ultimately formed, which covers the entire floor. This is stalagmite. The stalagmitic sheet cannot be formed more rapidly than the limestone is dissolved, which again is the function of the amount of carbonic acid in the water."† Could any description be better ; at the same time it points to a probable cause of non-uniformity ; for anything which could cause an increase or decrease in the amount of carbonic acid in the water would hasten or retard the accretion of the stalagmite. I suggested in *Nature*, January 1st, 1874, "that when the thick forest (the habitat of the animals whose bones were found in the cave) left an accumulation of decayed vegetation on the soil, we had the natural laboratory where the rain would find the carbonic acid to act as a solvent upon the calcareous earth ; but as by the axe of man the forest decreased, in that proportion the chemicals lessened, and, as a consequence, the deposit diminished."

Mr. Pengelly in an address at Teignmouth, July, 1874, replied to the above by producing Liebig's chemical analysis of various kinds of vegetation, showing that equal surfaces of cultivated land of an average fertility are capable of producing equal quantities of carbon, whether it consists of trees, corn,

\* Mr. Howard has some valuable remarks upon this subject in his paper read before this Institute on the Torquay caverns.

† *Kent Cavern, its Testimony to the Antiquity of Man*, December, 1875, pp. 8, 9.

hay, or straw; but he has left out the element of *decay*. The laboratory that I mentioned was the accumulated *decayed* vegetation which would naturally belong to an undisturbed forest.

Since I made that suggestion in *Nature* I have again visited the cave, and not satisfied this time with seeing its interior, I obtained permission to examine the summit of the cavern. It is now a gentleman's private grounds. The gardener pointed out to me certain spots where could be distinctly heard the workman's hammer when he struck the top; the thickness was not great. But what I want to direct attention to is this, that instead of the decayed vegetation that appertains to an unfrequented forest, it is now a gentleman's lawn, from which the gardener's broom removes every seared leaf. The conditions are altered; the laboratory is removed, less of the limestone is dissolved, and as a consequence the formation of stalagmite must be slower.

In the report read before the British Association at Exeter\* Mr. Pengelly says, that "it may not be out of place to state here as a fact of at least large generality, and to which there is no known exception, that in those branches of the cavern where the drip is at present very copious the stalagmitic floor is of great thickness, and where the drip is but little there is no floor, or an extremely thin one; that, in short, the present amount of drip in any locality affords a good index of the thickness of the floor there."

Is it probable that for 7,750 years there has been a uniformity of drip in any one spot, seeing that any accidental accumulation of vegetable matter that retained the surface water at one time more than at another, would alter that drip; and without uniformity of drip it is shown by the above quotation that there would not be uniformity of accretion.

The non-uniformity of stalagmitic accretion is observable in Poole's Cavern; for this boss, taken from the gaspipe, commenced forming at the rate of an inch in four years; but it did not long continue to form at that rate, for the present measurement of the boss proves that it fell to a formation of an inch in  $16\frac{1}{2}$  years.

Now uniformity of accretion is necessary to the correct action of Mr. Pengelly's chronometer.

It is no venture to say that neither in this nor any other country has any cave had more careful and scientific exploration than has this of Kent's Cavern; and no explorer could be more explicit than Mr. Pengelly in telling us all the facts of the case.

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\* *British Association, 1869, pp. 16, 17.*

But the thirteen or fourteen years that Mr. Pengelly has had the cave under his careful inspection does not enable him to say at what rate the stalagmite formed 2000 years ago. His data for computation cannot possibly extend back farther than the year 1604, for that is the earliest date yet found in the cave."\* And there is no evidence whatever to show that since 1604 the deposit has been uniform. The date only shows that  $\frac{1}{20}$  inch of stalagmite has deposited since that time; it does not show that its equivalent, *i.e.*  $\frac{1}{5000}$  part of an inch, has formed annually. There is in reality no evidence to show that stalagmite has formed at all since Mr. Pengelly first visited the cave in 1834. The  $\frac{1}{20}$  inch may have formed in a comparatively short time, and then the work may have ceased. The drip from a limestone roof is not always depositing stalagmite; the quantity of carbonate of lime in the drip may be variable, or the deposit may entirely cease. In my judgment, the approach of stalactite and stalagmite in Cheddar Cavern is a case of this kind. A single drop of water suspended from the point of one touches the point of the other, and this has been watched for the last forty years, but they have not united, nor can the least increase of either stalactite or stalagmite be detected.

If, then, there is no evidence of *uniform* accretion for the past 250 years, it is something tremendous to base any conclusion upon a supposed uniformity for a period of 7,750 years, especially after Mr. Pengelly's own caution, "that it is unsafe to use the rate at which stalagmite accumulates in one branch of a cavern to measure the time represented by the stalagmite in any other branch of the same cavern."

I therefore object to applying the scale of  $\frac{1}{20}$  of an inch in 250 years (if even the uniformity of the accretion could be proven) to the  $1\frac{1}{2}$  inch of stalagmite covering the extinct mammalia, because it would be applying the scale belonging to the "Cave of Inscriptions" to the stalagmite of the vestibule, which Mr. Pengelly says that it is unsafe to do.

It would be unsatisfactory to all parties, but especially to the Palæontologist and to the Anthropologist, for, in the first place, it would put man in the wrong position with regard to the extinct mammalia; for if this scale be applied to the vestibule stalagmite it would go to prove that the antiquity of the men who made the bone awl and the harpoon is above eleven times greater than the extinct cave-bear, cave-hyæna, mammoth, and *Rhinoceros tichorinus*, for their works of skill were from 12 to 20 inches (average 16) beneath these mammalian

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\* *Notes of Geology and Palæontology of Devonshire*, part i. (July, 1874), p. 23.

remains, whilst there was but  $1\frac{1}{2}$  inch of stalagmite above them.

This would be quite a new lesson in Palæontology, and would lead us to ask the question whether it is the antiquity of man or the antiquity of mammoth we expect to prove by their contemporaneity.

And, secondly, it would reverse all our ideas about progression; for in the black mould above the stalagmite was found a bone needle, and the man who made that needle must, according to the evidence, have lived about 2,000 years back; but in the black band beneath the stalagmite there was found another bone needle; and if we allow the scale of  $\frac{1}{20}$  of an inch in 250 years to be applied, it would place the artisan who made the latter needle 87,000 years before the one who made the former,—long enough, one would say, to perfect the art of needle-making; but it is very disappointing to have to quote Mr. Pengelly's words, for he says of the modern needle, that it is "by no means so elegantly designed or so highly finished as that just described,"\*—that is, the ancient needle. Eighty-seven thousand years, then, show no progress in needle-making, but the opposite.

But what say the advanced anthropologists to the 9,750 years for the age of the extinct mammalia? Whilst I have given my reasons for not accepting so long a period, there is no observed case of stalagmitic accretion that will make it longer. We have not to enter upon the question of how long cave-bear, cave-hyæna, mammoth, and *Rhinoceros tichorinus* have existed, the question that we have to answer is, At what period did they become *extinct*? Was it 200,000 years back? The British caverns answer emphatically, No, nor 10,000 years back. The extreme basis of calculation, stretched beyond all probability, refuses to reach beyond 9,750 years, whilst all the other cavern evidence points to less than half that time; and, as a consequence, the conclusion is inevitable, that the contemporaneity of man with the extinct mammalia, as evidenced by British cavern-exploration, lends no countenance to the doctrine of Man's Antiquity.

The CHAIRMAN.—I have now to return the thanks of this meeting to Mr. Callard for his extremely interesting, logical and well-expressed paper; and in so doing, I am sure all will desire that I should include Mr. Gorman, who, on account of the author's indisposition, has read the latter portion of the paper. I think Mr. Callard will acknowledge that Mr.

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\* *Fifth Report*, read at Section C, British Association, Exeter, August 20, 1869, p. 4.

Gorman has done him perfect justice. (Hear, hear, from Mr. Callard.) It is now open for those present to offer remarks upon the paper.

The HONORARY SECRETARY.—Before the discussion commences, I have to read a communication\* from Professor Boyd Dawkins :—

“Sir,—May I ask you to be kind enough to read the following note to the Victoria Institute, as, unfortunately, I am compelled by my engagements in

\* The following communication was also received from T. L. Strange, Esq., lately a Judge of the High Court of Madras :—

“The question raised by Mr. Callard is assuredly indissolubly linked with a circumstance of great influencing importance, to which he has given no consideration in his paper. The osseous remains, the antiquity of which is to be judged of, belong to all climes, assembled together in the same region, raising the inevitable inference that the locality where the several species of animals they belong to have flourished, must have had transitions of climate of a nature to correspond with the necessities of their existence. The lion, tiger, hippopotamus, rhinoceros, and hyena could not have occupied Britain but with the condition of tropical heat indispensable to their being; nor could the hairy mammoth and the reindeer have lived there without arctic cold. The animals of the temperate zone were also in the land, as now possessed by them. Other very apparent indications of these climatic changes exist, where coal, the product of plants of tropical growth, and ice, to a thickness of 3,000 feet, as shown by Mr. Geikie, have predominated in one and the same portion of the globe, as in Scotland.

“It would be natural to infer that such changes must be the result of fixed law, and not arising merely from the combination of adventitious circumstances, and that they must consequently be recurrent, the temperature, through invariable operating causes, gradually altering between the extremes of heat and cold. Mr. Geikie’s observation that the glacial visitation has occurred several times, supports the idea of regular recurrent law.

“It should also be the case that the supposed law should be of universal prevalence, and not confined to any one portion of the globe,—that every part of the earth passes from a torrid to a frigid climate, incurring also every intermediate grade of temperature. Accordingly, coal, requiring tropical heat for its production, is found within eight degrees of the North Pole, or as far as our explorers have been able to force their way in that direction, and traces of the prevalence of ice have been discovered in tropical regions. Professor Agassiz found at the embouchure of the Amazon, or in the latitude of the equator, proofs of the deposition of some vast glacier, which he presumed had stretched from the Andes to the Atlantic, and concluded that that sea, in the said quarter, had at one time been as much blocked with ice as is the Polar Sea. Mons. Du Chaillu, to his intense astonishment, observed what appeared to him indubitable erratic boulders in equatorial Africa; and I and others have seen similar boulders scattered over the elevated table-lands of Mysore and Bellary, borne thither, apparently, from the great chain of mountains that runs from above Bombay to Cape Comorin, along the western coast of India. One such well-known boulder has been arrested at St. Thomas’s Mount, the artillery station, within eight or nine miles of Madras.

“To convert such a climate as exists at the poles into one such as there is at the equator, and *vice versa*, it is obvious that the direction of the sun’s rays has so to be altered towards the parts to be thus affected, as would create the great heat to be introduced at one time, and the intense cold to be substituted at another. In other words, there must be that change in the

Manchester to refuse your invitation to the discussion on Mr. Callard's paper?

"The author of the paper has directed the attention of the Society more particularly to two explorations of caves with which my name is connected,

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polar axis of the earth relatively to the sun which would alone produce the effects in question that have to be accounted for. The sun, our great governor, it is fair to conclude, regulates all the important movements of the earth, and, among others, its diurnal rotation on its axis. Mr. Crooke's discovery of the motive power of light presents us with just the agency to effect such a movement. The sun itself rotates on its axis, and is believed, with all other heavenly orbs, to be in progress round some very distant and common centre. The sun is thus not a fixed body, but is subject to those external influences and consequent divergences which we see prevail among the planetary bodies, including the earth, from the associations with one another in which they are involved. Thus, it is easy to suppose that there may be such a constant alteration in the line of the sun's action upon the earth as would effect the continuous change in our polar axis now in view. That astronomers, in the course of their observations, maintained persistently and with suitable instruments only in comparatively modern times, have failed hitherto to detect such a movement, is no proof of its non-occurrence. The movement would be a very gradual one, to be ascertained only at long intervals of observation, and difficult of detection among other complicated operations influencing the sun's position relatively to the earth, such as the precessional rotation of the poles with its nutatory divergences, the alteration in the angle of the ecliptic, and that in the ellipticity of the orbit.

"To pass now to the testimony of the cavernous deposits, it appears to be a law that the stalagmite floorings repeat themselves, and are not restricted in the instance of each cave to one such coating. There are two such floorings in the Windmill Cave at Brixham, in Poole's Cavern at Buxton, in the caves of the Wye, and in the Trou de la Naulette, near Dinant, in Belgium. Kent's Cave, near Torquay, has had three such floorings, its capacity in depth and its antiquity having apparently permitted of the additional coating, and should the limits of depth and antiquity allow thereof, more, it may be presumed, would appear here or elsewhere. Now, what, it may be asked, can be more reasonable to suppose than that the stoppage and renewal of the drip, necessary to allow of the occurrence of these distinctly divided floorings, has been occasioned by these caverns passing into a glacial temperature which has frozen up the drip, and afterwards into a warmer one, which has thawed and renewed it?

"In Kent's Cave, on the upper floor of stalagmite, are inscriptions reaching back beyond 250 years, the deposition on which is estimated to have been at the rate of but one inch in 5,000 years. The floor here measures several feet in thickness, so that the formation of a floor occupies a very lengthened term of years, as the necessities of the case suggested by me require. This floor, as I must presume from its advanced stage towards attaining the proportions of the one below it, was commenced long ago, or when the cavern was set free of the domination of ice in the vicinity of the South Pole, and will be maintained until it reaches a corresponding propinquity to the North Pole. The floor, it will thus appear, must have passed, in the process of its deposition, through the equatorial or tropical region. A portion of a human jaw with some teeth has been met with in this floor, where it had attained a thickness of 20 inches; and below the floor, at a spot called the black band, have been found abundance of charred wood and some artificially formed bone implements, giving indubitable evidence of the existence of man at the

and on which I would make a few remarks. With regard to the Victoria Cave, the author very naturally assumes that the account of the exploration was the formal decision of the Committee, after weighing the evidence. It was, however, merely the private opinion of the Secretary, who, as a matter of fact, is solely responsible for the conduct of the exploration, and for the reports. My name, among others, was on the Committee, but since my retirement from the office of secretary, up to the last British Association Meeting at Dublin, I was unfortunately out of England when the reports were read. At that meeting I took the first opportunity open to me of expressing my non-acceptance of the Report, and of the evidence as to man in that cavern. The Report was not approved by the section, and the British Association grant was no longer made. The supposed human fibula found when I conducted the exploration was so equivocal that I put it aside without any remark. Subsequently, however, on the authority of one of the best osteologists in Europe, I accepted it as human ; but ultimately, on fresh evidence which I immediately brought before the Geological Society and the Anthropological Institute, I held it to be ursine. The cut bones of the goat, and the small fragments of bone and teeth either of sheep or goat, which have been assumed to belong to the lower strata in the cavern, are obviously recent, and have dropped from

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very remote period which the locality indicates. The remains of extinct mammals also here appear. At the Trou de la Naulette human osseous remains have been discovered below its second stalagnite floor.

"These, then, are the conditions to be accepted if fair inferences have been drawn from the facts apparent. At some very remote distance of time, beyond all bounds of history or tradition, the lion, the tiger, and the elephant, have roamed about in Britain, possessing there a tropical climate as necessary for them ; at a still more remote period this region has been covered with a coating of, say, 3,000 feet of ice, placing it within arctic limits ; and still further back, at some inconceivable distance of time, the human race have been found, by the traces left, to have had existence on the earth.—I am, Sir, yours truly, T. L. STRANGE."

[The foregoing, not having been read at the meeting, is inserted as a note. Many of the points alluded to herein were taken up in the discussion. It would require much time to consider the whole of the questions raised, upon some of which leading scientific men are still at issue ; in regard to these we shall do well to follow the suggestion in the last paragraph of Mr. Mello's remarks (p. 237). The following are Mr. Callard's comments :—

Mr. Strange, in his letter, raises a very interesting question of the possibility or otherwise of a change in the polar axis being the cause of great climatic changes. To this question, as Mr. Strange observes, I have given no attention in my paper, and for this reason, that the woolly mammoth, which we relegate to the cold regions, is not divided by any geological stratum from the hyæna, which is supposed to belong to a warm climate, but they are found side by side in the same stratum of cave-earth, and in the same foot of stalagnite, in which case there could have been no change of climate between the existence of the one and the other of these mammalia to have arrested the flow of stalactite by the frost, and again to have released it by a thaw,—and no evidence of the immense periods that would be required for the astronomical changes supposed. It is a very common assumption, but I believe an erroneous one,—that the present habitat of an animal is its necessary habitat.—T. K. C.]

the upper stratum of Romano-British age, in which they are very numerous. Unfortunately this faulty evidence has been taken by eager scientific imaginations to stamp the Preglacial age of man, and it presents a fair mark for criticism, such as that of Mr. Callard. It has, however, no more weight on the general question of man in caves, than the evidence of a witness would have in a court of law about things which he never saw or never heard of. It is simply out of court.

"The discoveries in caverns, from the Pyrenees as far to the north as Derbyshire, and as far to the east as the Danube, prove beyond reasonable doubt, that man lived in Europe at the same time as extinct animals such as the cave-bear and the woolly rhinoceros ; and works of art, of the same kind as the sketch of the horse in the Robin Hood Cave at Cresswell, have been met with in Belgium, France, and Switzerland, under conditions which prove that the Palæolithic hunter delineated on bones and antlers, with remarkable fidelity, the animals which he hunted. With regard to the hog-man in the sketch of the horse, supposed by Mr. Callard to have been cut, it does not seem to me to show any sign of cutting. Were it cut it would imply that the horse was domestic. No domestic animals have yet been found in any of the undisturbed older deposits in caverns.

"When the author concludes that the hyaena and woolly rhinoceros were living in Britain as late as the Roman times, because they were found in the Cresswell Caves in which Roman pottery and other remains were also found, he ignores that the articles of Roman age were always met with either in the surface soil above the stalagmite, overlying the older deposit with those animals, or in places which had been disturbed by digging, and by the burrows of rabbits and foxes.

"Other and minor points relating to other caves raised in the paper may safely be left to the consideration of those more particularly interested in them. It merely remains for me to repeat, that in dealing with the question of the antiquity of man, it seems idle to attempt to build up a chronology in terms of years, beyond the written record. Out of the reach of history there are no natural chronometers. The rate of the erosion of a valley, of the deposition of silt in the bottom of it, or of the accumulation of stalagmite in a cave, are equally uncertain, since they depend upon variable and intermittent causes. The rainfall may vary, or the silt-laden waters of the stream take a different direction, or the flow of water containing carbonate of lime may cease. They are, therefore, blind guides to the lapse of time. The antiquity of man is to be measured, not by years, but by the series of events which have taken place since he hunted the mammoth and woolly rhinoceros, reindeer and horse, and fought with cave-bears and lions in France and Britain, in the Pleistocene period. Measured by the geographical and biological changes which have taken place since that time, it seems to me so vast, that all the events recorded in history,—Egyptian, Assyrian, Greek, Roman,—are in comparison things of yesterday.

"Yours truly,                    "W. BOYD DAWKINS.

"Captain F. Petrie, Hon. Sec."

**Rev. J. M. MELLO.**—I have to express my thanks to the President and Council of this Society for having kindly given me the opportunity of being present this evening, and taking part in the discussion on the interesting subject which has just been brought before us.

The question for our consideration is one of great difficulty ; indeed, I doubt very much whether, in our present state of knowledge, we have anything like sufficient facts to enable us to form any decided opinion, whether we ever shall have a sufficiency, is perhaps doubtful ; any way, I think that our work at present should be rather to accumulate facts without being too careful to form theories upon the few we have ; as to the result, I have no doubt whatever that as it has ever been in the past, the more we know of the works of the Great Creator the more reason we shall have to see one and the same Divine Hand in the Word inscribed on the face of Nature, and that written in the sacred documents of our religion.

I must now ask your indulgence whilst calling attention to several points in the paper we have heard read, in which the author has, I am sorry to say, greatly misapprehended some of the facts derived from the exploration of the Cresswell Caves. In a question such as that before us, it is, I conceive, of the utmost importance that every fact on which we take our stand should be incontrovertible, otherwise the argument, however strong it may be in some respects, will serve but to confirm its opponents in their own views ; and agreeing as I do with Mr. Callard that we have no evidence at present which forces us to assign a practically unlimited antiquity to our race, and also believing that there is much which disproves it, it will yet be a very dangerous thing if we base any of our arguments on fallacies. The inference Mr. Callard appears to draw from the Cresswell explorations is that our Derbyshire men were not those commonly known as Palæolithic, and that the rhinoceros and hyæna and other Pleistocene animals, which he allows to have been their contemporaries, were themselves living in this country with the Roman and Samian potters ; and that, it may be observed, if there is any truth in the generally received views as to the date of the articles of Roman art found in British caves, would give us a date somewhere about the fifth or sixth centuries of our own era ! This conclusion is arrived at through a misunderstanding of the results of our digging, and you will perhaps allow me to lay those results before you as briefly as I can.

If the Cresswell Caves are remarkable for one thing more than another it is that in them we have the clearest proof that has ever been afforded of a chronological progress in civilization amongst the earliest occupants of this country. Mr. Callard says of this Derbyshire man that he was "most assuredly not Palæolithic man" ; if he was not, then Palæolithic man has no existence anywhere. A section of the floor of the Cresswell caves presents to our view a perfect and well-defined succession of beds of different lithological character : at the bottom we have red argillaceous sand ; over this comes the cave earth, in various stages ; then the breccia ; and, above all, the thin surface soil. Palæolithic man in his earliest condition was undoubtedly

"a low savage," his art did not extend, as far as we know, beyond the skill to fashion the rudest implements ; this is borne out by the Cresswell Caves : the red sand contains no trace of a higher civilization than that represented by those rude quartzite implements which you see before you,—mere pebbles fractured in the roughest possible manner,—implements, the nearest approach to which elsewhere is found in those of the old river gravels of the Somme or the Ouse, or in the rough tools of the Moustier cavern, or of the lower stratum of Kent's Hole, or of the Trou de l'Église at Excideuil, which latter cave has yielded evidence very similar in character to that of Cresswell. The bed containing these implements has yielded no trace of higher art than this ; it is not till we reach the overlying cave earth that we get evidence of the use of flint, and then at first the chipped flints are as rude in form as the quartzites ; higher up we meet with the more elaborate forms such as those lance-heads of well-known Solutré type, and with these, and at no lower level, we obtain the worked bones and the engraved figure of the horse of Madeleine character. Similar flints occurred in the breccia in conjunction with the Pleistocene mammalia. As yet there is no evidence of the existence of Neolithic man, nor of the modern fauna of Europe, far less of the Roman occupation. We have no evidence whatever in these caves of the presence of the men of the Neolithic race, who used such highly-finished or polished implements as these exhibited, which are recognised types of their class. As to the Roman remains, the pottery and the bronze fibulae in the surface soil, these, as far as one can judge, belong to a period as late as that of the withdrawal of the Roman legions, when the more or less civilized Britons were driven to the caves by the invading hordes which then overran the country.

Just as there is no trace of this late art, or of the recent domestic fauna, in the lower beds of the caves, neither is there any real proof of the existence of the Pleistocene fauna in conjunction with Roman or even Neolithic remains of man. Mr. Callard has alluded to a passage in my first paper, in which it is true that I have said that in the surface layer of the Robin Hood Cave some teeth of rhinoceros and of hyæna were found, as well as some flints ; and a little lower down I have stated that Roman pottery was also found in the upper part of the floor of this cavern. These Roman remains were found in a small inner chamber in the surface-soil, together with recent bones, but without any trace of Pleistocene animals. As to the teeth, these were found near the entrance of the cave, and the search made at that time consisted merely of a small test-hole rapidly and not very carefully made. My first paper must be checked by the more careful work recorded in the subsequent ones. The red sand was found capped by cave-earth, and there is little doubt that the teeth really belonged to that ; but, any way, it is utterly impossible to obtain any chronological data of even the slightest value from things found in the few inches of surface-soil in a cavern that has been frequented for years by innumerable visitors. Roman and other remains prove the existence of their former owners, but under circumstances totally precluding the possibility of saying whether or no they were contemporaries unless we have independent proof ; and to say that because a rhinoceros

tooth is found in disturbed surface-soil with Roman ware the two were of the same date, is as fallacious as it would be to say that, because we have found, as we have found, in another part of the cave, Roman, Mediæval, and modern pottery, and even fragments of tobacco-pipes, mingled in the surface-soil, the Roman and the Mediæval potter, and the user of the clay-pipes, must all have lived together in the same age. There is another point which must not be passed over. Mr. Callard says, as I gather from p. 218, that the men of Cresswell wrought in iron ; on the next page he says they hammered out iron implements, and with metal shears cut their horses' manes. The proof he gives is, that they left behind them some ironstone implements. But surely there is an enormous difference between chipping a rude tool out of a bit of the Derbyshire clay ironstone (this is one of the implements in question) and forging a tool out of metallic iron ! The use of metals, as far as we have evidence, was utterly unknown to the Palæolithic hunters. As to the hog-maned horses, if their manes were artificially produced,—which I am not prepared, however, to grant,—why might they not have been singed ? We know that these men were acquainted with the use of fire. But it is not at all unlikely that the ~~cave~~ horse, with its large asinine head and small limbs, like the ass or the zebra of to-day, had a short erect mane, as represented in all the old Palæolithic drawings ; we have no reason to suppose that the men of that period had succeeded in domesticating the horse, although they would frequently kill it for food.

The evidence of Cresswell then, as I read it, tells us nothing as to the antiquity of the earliest men in England, only that they lived in conjunction with animals long since extinct, or to be found only in distant countries,—animals concerning which history is absolutely silent ; and we can scarcely think that had the Romans met with or heard of the mammoth, the rhinoceros, or the formidable machairodus, or hyæna in North-Western Europe, such a remarkable fact would have escaped the notice of such observant writers as Cæsar or Tacitus ; and, besides this, all the negative evidence we have tends to show that the Pleistocene mammalia, with but few exceptions, were unknown to the Neolithic men, who were separated from their predecessors by an unbridged gap.

There are other points in the paper we have heard read which will, perhaps, be noticed by others ; but I fear that I have already taken up far too much of your time : my excuse must be the great importance of obtaining exact evidence. I think the question of the antiquity of man, as far as geology has anything to say about it, rests now pretty much where it did years ago. We have no proof that will stand the test of close examination that man was pre-glacial ; nor, on the other hand, have we any as to the date of his first appearance in North-Western Europe. It was certainly pre-historic as far as these countries are concerned, and the changes that have taken place in climate and in physical geography, as well as some other considerations, seem to show that a lengthened period must have elapsed since Palæolithic man disappeared ; any computation as to the exact time cannot be anything but mere guesswork, as far as I can read the evidence of British caverns. I

see no possibility at present of getting any clear answer from geology as to the antiquity of man ; but that that antiquity was so great as we are asked by so many nowadays to concede as beyond question, may well be doubted, on grounds which I cannot now enter upon, and so far I agree with Mr. Callard.

But there is no conflict between any clearly ascertained scientific fact and religion, the only conflict is between science and erroneous interpretation of Scripture, or between unstable scientific theories thrust into opposition to the Bible. We are far too apt to interpret the work of the Semitic writers as we should a modern book, and to apply to it the same canons of interpretation that we should to some work of English genius, even occasionally building arguments on the uncertainties of our own version of the Bible, and thus discrepancies are often made to appear where there are none, through over hasty and unsound interpretations.

As earnest students let us accumulate facts, and be very slow to form theories ; let us wait and be patient, and in time, though it be beneath the crossed swords of the controversialists, as through a triumphal arch the divine form of truth will be seen advancing ever nearer and nearer into the perfect light.

Rev. W. B. GALLOWAY.—I think we must all join in thanking Mr. Callard for his interesting and well-reasoned paper. (Hear, hear.) With regard to the contemporaneity of the mammoth and other extinct manmalia with any of the Roman remains, I must confess to feeling very doubtful on that point, and I think the objections made to such contemporaneity will probably be found valid ; but as my first acquaintance with geology was formed soon after Buckland published his " Reliquæ Diluvianæ," and during the time that Cuvier was hailed as a high authority on these subjects, I may be permitted to say that I think their theory has not been well superseded by the present glacial theory. It was made a subject of ridicule by unbelievers in a former age, that men should be so credulous as to believe in a universal deluge,—a deluge in which the world was covered by water ; but we now find substituted for that a deluge of solid ice, in which Scotland is affirmed to have been buried under a depth of 3,000 feet of ice, and Switzerland to have had its valley between the Jura and the Alps filled up by an entire glacier, so that rocks slid down from the Alps upon the Jura. We are further informed by these theorists, that America was covered by glaciers varying in depth from 7,000 to 8,000 feet, Scandinavia by glaciers varying in depth from 7,000 to upwards of 8,000 feet, and that all Europe bears evidence of this enormous depth of ice—solid ice—having covered the world. I think if Voltaire were again in life, and still disposed to ridicule the theory of a universal depth of water having covered the hills, surely he might find some ground for ridiculing the credulity of those who accept the latter hypothesis. (Hear, hear.) For my part, I feel that it is worthy the consideration of geologists whether Cuvier's and Buckland's theory was not the truer of the two. (Hear, hear.) I find in " Lyell " that he supposes the contents found in the caves that have been mentioned, ascribable to the caves having been

the channels of subterranean rivers, such as are found in the Morea and other parts of Greece ; but there is no proof of there having been any outlets for such rivers, and nothing to disprove the theory of Buckland and Cuvier that the deposits are diluvial. We have also found,—at least, there have been found,—remains of the mammoth in icebergs and vast formations of ice at the mouth of the Lena ; but it is affirmed by Croll and others, whose theory has been well noticed by Professor Birks in a recent contribution to this Society, that the Glacial age is to be attributed to an alteration of the eccentricity of the earth's orbit and a change in the relations of the pole to the line of the apsides,—two of the slowest processes in nature, in which 10,000 years would make probably very little difference in the degree of cold. Now, the mammoth that was frozen up in the mouth of the Lena must have stood waiting a long time for his being frozen up in the ice in which he was afterwards found, if the freezing was attributable to either of these causes, or to both combined. It seems to me that Cuvier's affirmation—that the catastrophe by which the animals were frozen up in the ice, or their remains deposited in the caverns in which they are found, must have been sudden—is the more reasonable, and that no change requiring the lapse of ages, would account for the phenomena at present exhibited in the things we are discussing. In the remarks I am making I earnestly desire to draw the attention of those who are strictly engaged in geological studies, to the question,—Whether they have done wisely in accepting this theory of one enormous glacier spread over the world, in preference to the Scriptural doctrine of a universal deluge ? (Hear, hear.) If we revert to that, then the contemporaneity of man with these fossil animals is beyond a doubt. The event by which these animals were swept from the face of the earth is then attributable only to the period of the Deluge. With regard to the Palæolithic implements, I must say, referring to an exhibition of them which was made by the Royal Society of Antiquaries in Somerset House a few years ago, it struck me that if evidence as weak as that furnished by these implements were produced for the purpose of shaking the oath of any man in a court of justice it would be treated as a subject for laughter. (Hear, hear.) How, then, should we consider such evidence as these implements afford, where we find that men of equal judgment with those who regard them as the work of man have concluded that they were the work of accidental fracture, simulating the work of man ? How are we to say that these implements should be accepted as of sufficient weight to reverse the statements of those who wrote in the fear of God, even if they should not be admitted to have written by divine inspiration ? (Hear, hear.) They, at least, wrote with all the solemnity attaching to an oath, and I think it is unfair that the records of Scripture should be considered as in the least degree liable to be shaken by any of the Palæolithic evidence that has been produced. The occasional forms of the roots of trees may simulate the shape and appearance of the head of an animal, and there are many occurrences in nature, in which the similitudes are such that we may be liable to make mistakes about them. In one of the best shaped of the Palæolithic imple-

ments that I remember having seen, it would have required an enormous hand to have wielded it, and in other cases it has seemed to me that the hand which used the implement was likely to have suffered fully as much as the enemy against which it was directed. With these few remarks I must apologize for having so imperfectly stated what I deem to be the difference between the Glacial and the Diluvial theory ; indeed, the latter can scarcely be regarded as a theory, since it rests upon Scriptural testimony ; but my wish is most earnestly to suggest that the points I have ventured to put before you are worthy of examination, and that the names of Cuvier and Buckland are deserving of the respect of the geologists of the present day. (Applause.)

Mr. D. HOWARD.—Mr. Mello has asked very fairly whether, if the extinct animals lived up to the date of the Romans, we should not have heard something about them ; and this is certainly a strong argument against finally accepting the suggestion that the extinct animals were to be found in England at the time when Caesar wrote. At the same time, I would ask,—are we quite sure that we have not the records of the existence of those extinct animals at a somewhat older date, in the traditions that are to be found among almost all nations of strange and monstrous beasts ? It is a curious fact that we find some remarkable coincidences between some of these old traditions and some of the discoveries that have been made in modern times. Take, for instance, the gorilla, it is evident that this animal answers the descriptions given of the " wild man " by certain of the early writers,—although we denied the existence of anything but imagination in those early writers until we found the animal itself. Is it not curious also that the early hunters are invariably said to have chased monstrous beasts, and that the descriptions given of these creatures do most nearly approach the forms of the extinct animals ? It seems surprising how the evidence of immense antiquity disappears in the comparatively high position in which the remains of these animals were found in the stalagmite of Kent's Cavern, as well as the animals found in the flesh at the mouth of the Lena. (Hear, hear.) The traditions of monstrous beasts, which might very well have been these creatures themselves, all seem to point to the idea that these animals have been, if not actually contemporaneous with the Romans, at least contemporaneous with our not very remote ancestors ; and it is not merely a question of whether they existed 9,000 years ago, but of whether they were in existence 2,000 or 3,000 years ago. It is certainly easier to believe that the frozen beast on which the dogs actually fed lived 2,000 years than 10,000 years ago. (Hear, hear.) It is likewise easier to believe that an inch of stalagmite which preserved some of the bones found in Kent's Cavern took 2,000 years for its formation than that it took 10,000 years. Certainly the more recent discussions on this subject have brought out very clearly that stalagmite does form very fast. I think the testimony of our old traditions, and even of our nursery tales is not below the notice of scientific men,—there must have been some reason for them. Some have even gone so far as to say that the universal

belief in a dragon is actually the survival of the memory of some stray plesiosaurus which had remained to a comparatively recent age. There is one thing that I would ask, and it is this : if we had no evidence of the recent existence of the *Dodo*, should we not be tempted to say that it is a very long time since it existed ? (Hear, hear.) The fact that an animal may become so absolutely extinct that even a small portion of it is very difficult to find within not thousands of years, but barely hundreds, is one of the most curious pieces of natural history that I am acquainted with. I do not know that we shall ever see a mammoth walking about this earth in the present day ; but still more surprising things might happen. (Applause.)

Rev. J. JAMES.—I think the canons of caution laid down by Mr. Mello are quite as valuable in regard to our method of ascertaining facts, as in regard to our method of forming theories. This I would illustrate by a circumstance which I lately found recorded in print ; and as the record is not very long, I should like to be allowed to read it. It is a statement made before a public society concerning a case in which Professor Owen was saved from imagining that he had made a great discovery in the North of England some twenty years ago, when the great dock in the Tyne was made. It says,—“ Many trees and horns of ancient animals were found embedded in the silt of Jarrow Slake. One of these was standing upright, but without its head. Its top had evidently been cut off ; there could not be any mistake about the fact. Sir William Armstrong, the late Robert Stephenson, and Mr. Harrison, the North-Eastern Company’s engineer, were greatly interested. It was concluded that some woodman of very ancient times had cut the tree, and that it was a most striking evidence of the extreme antiquity of the human race. In haste, Professor Owen, the renowned palaeontologist of the British Museum, was sent for from London. One Sunday morning was spent by all these gentlemen wading in the slush and mud inspecting this wondrous relic. Their conclusion was unanimous. The next morning a friend of mine to whom Professor Owen had sent his card, with the expression of a wish to see some horns he had from the same site, was present also. He asked Professor Owen to what conclusion they had come ? The Professor replied that they were all unanimous, and that the evidence was most satisfactory. My friend said,—‘ You have not been inspecting an old cut, at any rate, for I had some pieces cut off from that tree a few days ago, and have them now at home.’ The assembled company declared it was impossible. My friend assured them of the fact, and said ‘ Have you seen the man who first uncovered this tree ? ’ They said they had not, and Professor Owen was at once struck with the importance of having that man’s evidence. The man was sent for. My friend told him what the man would tell him, for my friend knew all about it, and besides that, would never have been so deceived, for reasons I could give even if he had not known the true history. But I will let Professor Owen tell the rest in his own words. He told the story himself at Leeds some few years afterwards, and this is what he said :—After giving his account of the portion of the story I have already related, and saying he had been told that the navvy who first uncovered the tree had

himself cut the head of it off to lay down a sleeper for the tramway, he said,—‘The man was sent for, and on his arrival he declared that the tree pointed out was the one he had cut.’ Professor Owen goes on to say—and we should mark this,—‘It was endeavoured to be explained that that was impossible, as the place had not been excavated before’ (it had got covered up again since its first excavation), ‘but looking,’ said Professor Owen, ‘with supreme contempt upon the assembly of geologists and engineers, the man persisted in the identification of his own work, and exclaimed, “The top of the tree must be somewhere ;” upon which,’ says Professor Owen, ‘I offered half-a-crown to the first navvy who would produce it. Away ran half a dozen of them, and in a few moments they returned with the top. Never,’ said Professor Owen, ‘had I so narrow an escape from introducing “a new discovery” into science, and never had I a more fortunate escape.’”

The CHAIRMAN.—Perhaps Mr. Mello would not mind pointing out what he wishes us to remark in the specimens he has brought here.

Mr. MELLO.—These rude implements of quartzite [showing them] are from the very lowest deposits. They are quartzite pebbles that were taken into the cave by the men who resorted to it, and were used, some as scrapers, very similar to those now used by the Esquimaux for cleaning skins, while others were used as hammers, probably for crushing bones, in order that the marrow might be extracted, there are a few flakes struck off the pebbles, and other marks of bruising on the face of them produced either by fracturing bones or breaking other stones — probably the latter. The marks are very fresh in appearance ; this one [holding it up] bears marks as fresh as if they were done yesterday. This [showing another] is one of the stone implements of a material similar to the iron ores that are now being smelted in Derbyshire. These [showing others] are the higher type of the flint implements. All these high-class implements, together with the bone implements, are from the breccia, or the upper cave-earth ; in fact, the breccia and upper cave-earth are one and the same : where the cave-earth is thin the breccia is thick, and *vice versa*. While the breccia was accumulating there can be little doubt that the thick part of the cave-earth was forming, and above that we get the Roman remains. This [producing it] is a solitary bit of Samian ware that I got, and then there were fragments of ruder Roman pottery of a very rough character. This [showing it] is the jaw of one of the devourers of the other animals,—the lower jaw of a young hyæna,—and I have proof that it was not imported from a great distance, but must have actually lived in the neighbourhood of the cave, for I have the jaw of a young hyæna showing the canine teeth coming through the jaw. Here [showing the jaw] you have the permanent teeth coming through, and the deciduous teeth on the point of being pushed out, while in the old grandfathers of the hyænas visiting the cave we have the teeth worn down to mere stumps. We have the same evidence of other extinct animals breeding in this country, for in the same cave we find the teeth of the baby mammoth not bigger than the top of my thumb, with other teeth 20 inches long [exhibiting them]. The Neolithic

age is not represented in our caves at all; but it is represented by this typical spear-head and these axes of Denmark, and the polished implements from the lake dwellings of Switzerland.\* Mr. Callard has a very fine specimen here from the Robenhausen district; also a fine Neolithic Danish spear head. We have nothing Neolithic at Cresswell: as to the bone implements, I have only drawings of them.

**Rev. J. FISHER, D.D.**—I must express the great satisfaction with which I have listened to the paper of Mr. Callard, with whose views I sympathize to a great extent, as I do also with those expressed by Mr. Mello, who has been very candid in his remarks; but, personally, I fail to understand the distinction that has been set up between the Neolithic and the Palæolithic. I think that some of the specimens which have been introduced are not of artificial origin. I have often, when a boy, found flints in my father's fields that I thought must have been made for our old Brown Bess musket, but, when I have shown them to my father, he has at once said, "No; they are the works of nature"; and I think that some of those before us have a similar origin. I am one of those who do not believe in the Palæolithic period being of the date that some geologists would assert. Of course, as one man is older than another so must one period be older than another, and thus we hear of the Palæolithic and the Neolithic; but may it not be that when we have had what is called the Palæolithic in one part of the world, we have had the Neolithic in the other; that is to say, there have been in two quarters of the globe at the same time two races, one tolerably far advanced, and another much less advanced, in the making of implements and so forth? I believe that if we go to the centre from which men have been supposed to diverge to different quarters of the globe, we find in Egypt and Assyria and Babylon, the Neolithic men, and I think it will be some time before you can point to a period that shall be so far distant as to justify the distinction that has been drawn between that and the Palæolithic.

**Mr. CALLARD.**—I am rejoiced to find that we are so nearly agreed to-night. I had thought I should have met with strong antagonism; but, instead of this, one speaker after another seems to have fallen in with my views to so great an extent, that I think we shall go away from this meeting saying we have given up the idea that has prevailed in some quarters as to the great antiquity of man. Professor Boyd Dawkins has been very candid in the letter he has sent, in which he gives up much of the evidence relied on for calculating man's antiquity. There is a little difference between us as to the horse's mane being cut. I have seen the drawing, about which there may be some difference of opinion; but, to my mind, the shape of the mane indicates clearly that it had been cut and not singed; and I do not think that on a question of science we ought to be allowed to bring in any fancy we like, in order to get over a difficulty. It is a hog-maned

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\* The demand for implements from the Swiss lake-dwellings has resulted in the establishment of a large manufactory for their production, near the lake of Bienne!—ED.

horse : Professor Boyd Dawkins says it is a hog-maned horse, and all we know of such manes is, that they are clipped and not singed, nor were they cut with Palæolithic implements. Therefore, as far as the evidence goes, I think it is on my side in asserting that they were cut ; that, being cut, they must have been cut by something like a pair of shears, and that if they were cut by a pair of shears, that fact brings us into comparatively modern times. (Hear, hear.) With regard to the pottery, it must be borne in mind that I did not say that the mammals referred to lived where they were found in Roman times. I did not even say that they lived at all in Derbyshire in Roman times. My remark was that "as in Devonshire so in Derbyshire the *rhinoceros tichorinus* is found amongst the pottery, the legitimate inference is that he was contemporaneous with the potters." The Roman or pre-Roman pottery, with the associated astragalus of rhinoceros, belonged to Kent's Cavern, not Cresswell, and I think I am justified in saying that they were so associated ; for Mr. Pengelly states that,—" In exploring the North Sallyport the overlying black mould yielded potsherds " (you could not have potsherds unless you first had a potter), " marine shells and bones (chiefly modern, but a few of extinct animals), the astragalus of the rhinoceros being the most important of the latter." You must not blame me, you must blame Mr. Pengelly, for saying that the astragalus of the rhinoceros was found among the pottery, or else you must blame Dr. John Evans for saying that the pottery of the black mould belongs to Roman or pre-Roman times. It is true that finding a tobacco-pipe, with Roman pottery in the surface soil, does not prove that these articles were contemporaneous, but it proves that they are both more recent than the stalagmite below them, and that is all that I claim for the astragalus of the rhinoceros. It was found in the black mould with the pottery, and therefore, however recent it may be, it cannot be older than the black mould i.e., 2,000 or 2,500 years. The pottery of Cresswell referred to was Samian. Mr. Mello, whom I am so glad to see here to-night, says respecting the teeth and pottery :—" My first paper must be checked by the more careful work recorded in the subsequent ones." Well, I am glad to do so, but I think Mr. Mello will have to correct both his second and third reports if I am wrong ; for in his second report he makes reference to " blasting the stalagmitic breccia which covered the cave-earth containing the bones and implements. In this breccia were found teeth of both *rhinoceros* and *hyena*." In the third report he says,—" The few remains found in the breccia consisted as before of the bones of the hare, a few teeth of the larger Pleistocene mammalia, *rhinoceros tichorinus*, *hyæna*, bear, horse," &c. Therefore, if Mr. Mello has come to a different conclusion it must be since he wrote his third report.

Mr. MELLO.—I have come to no different conclusion ; it quite bears out my argument.

Mr. CALLARD.—Then we are to understand that in the breccia covering the cave-earth, as far as it existed, were found the remains of extinct mammalia, and beneath the breccia in the cave-earth were found well-finished implements,—not, it is said, Neolithic.

Mr. MELLO.—All the Cresswell implements were Palæolithic.

Mr. CALLARD.—You showed us or referred to certain specimens of bone implements.

Mr. MELLO.—You get a similar form in the breccia, which I think is identical with the others.

Mr. CALLARD.—My point is established if the breccia was found above the implements, and the extinct mammalia in the breccia, which shows that the extinct mammalia must have lived after the men who made those implements.

Mr. MELLO.—*With* them. We got them in the breccia in a part of the same deposit.

Mr. CALLARD.—Professor Boyd Dawkins is rather particular in calling attention to the stalagmite *above*, and the remains *below*. He says, in his paper at the Conference of May 22, 1877, after describing the bone awls, needles, sketch of horse's head, and associated mammalian remains of the cave-earth, “*above* the strata containing these remains was a layer of stalagmite, ranging from 1 foot to a few inches in thickness.” The breccia is equivalent to the upper cave-earth, and the upper cave-earth will always be found to come above those implements that have been mentioned. If it be not so, I shall be happy to withdraw this part of my paper. Does Mr. Mello say that these implements are never found below the breccia in which the extinct mammalia are found?

Mr. MELLO.—Some are and some are not.

Mr. CALLARD.—If any of them are, my point is gained, namely, that some men lived with and some before that mammalia, and made these bone implements.

Mr. MELLO.—The same man lived during the breccia period and the cave-earth period. We had on the left-hand side the cave-earth on which the breccia had been gradually thickening, and on the other side the cave-earth and no breccia, the cave-earth being three times as thick as it was underneath the breccia.

Mr. CALLARD.—Do you claim for the implements so found that they are Paleolithic?

Mr. MELLO.—Yes ; they are Palæolithic.

Mr. CALLARD.—That is where I differ from Mr. Mello. Sir John Lubbock, when dividing these periods, speaks of the first, or Palæolithic, age as that of the drift when men shared Europe with the mammoth, and so on ; and when we come to the Neolithic age it is one characterised by beautiful weapons and instruments, made of flint and other kinds of stone, in which we find no trace of any metal except gold. Mr. Alfred Wallace, at the geological section of the British Association in Glasgow, in 1876, traces the periods the other way, and says, “as we go back, metals soon disappear, and we find only tools of stone and bone. The stone weapons get ruder and ruder; pottery and then the bone implements cease to occur; and in the earlier stage we find only chipped flints of rude design.” Now, if these definitions are accepted, then these chipped flints of rude design belong to the period of

the drift, and further back than the period of *bone* implements. If, therefore, we can find *bone* implements, we are not in Palæolithic times. (Hear, hear.) Reference has been made to instances on the Continent of Palæolithic engraved figures. I simply dispute their being Palæolithic for the reason that the definition given of the term "Palæolithic" does not answer to them. We ought when we reach the Palæolithic period to have got further back than the age of bone implements ; but they are found in the Cresswell caves, and very distinctly in Kent's Cavern, and also at Dordogne. When we have bone needles, bodkins, and other things all of bone, I cannot see how we can associate them with the Palæolithic age. But give it what name you like—call it Palæolithic if you please,—I would merely say it is such a Palæolithic age as Dr. Fisher refers to when he speaks of one man being older than another, and not such a Palæolithic age as has been defined by geologists. With regard to the question of iron implements in Cresswell caves Mr. Mello is right. The term does imply more than the evidence warrants. I should have said *ironstone* implements. I was justified in saying that they were wrought to approved forms. Professor Boyd Dawkins says of the Cresswell cave implements :—"Some of those of quartzite and *ironstone* were of precisely the same form as those of the river gravels of Brandon, Bedford, and Hoxne. They are identical with those found in France from St. Acheul, near Amiens." Does not this imply that they were manufactured into forms of approved types ? I quite agree with Mr. Mello as to the desirability of getting our facts together rather than paying too much attention to theories ; but it must be borne in mind that I did not create the theory of the "Antiquity of Man." (Hear.) It was created for me, and I have come here to combat it. I have now to thank you all very much for the kind way in which you have received my paper. I can only hope it may result in a further consideration of the subject, and if in anything I have been inaccurate I shall be thankful to be corrected. At present, however, I feel strong in the position I took when I read my paper. (Applause.)

The Chairman congratulated the meeting on the very interesting discussion that had taken place.

The meeting was then adjourned.